

with plasma based on an oxidizing gas, and after the oxidizing, treating the nitride film with plasma based on a treating gas comprising hydrogen gas.

In each of the foregoing processes, the initially-formed film (oxide or nitride) can be deteriorated by the plasma process used to form the subsequent film (nitride or oxide). By separately providing a treating step comprising hydrogen gas, the hydrogen gas-based plasma can affect the recovery of the underlying film. Because the addition of either oxygen gas or nitrogen gas to the hydrogen gas-based plasma would block the recovery of the underlying film, it is important to separate the film formation steps from the treating step.

None of the cited references teach or suggest the claimed 4-step processes, which include an initial cleaning step, an oxidizing (nitriding) step followed by a nitriding (oxidizing) step, and a treating step wherein the underlying oxide (nitride) film is treated with a hydrogen gas-based plasma.

Ohmi teaches a process for forming a stacked gate insulation film 12, which includes a silicon oxide film 12A deposited on a silicon substrate, and a silicon nitride film 12B deposited on the silicon oxide film (see paragraph [0095] and Figure 10). The silicon nitride film 12B can be formed using a plasma process gas comprising a mixture of N_2 and H_2 gas (see paragraphs [0073]-[0077]). Applicants note that Ohmi also teaches that it is possible to reverse the order of the oxide film 12A and the nitride film 12B (see paragraph [1000]). However, as acknowledged in the Final Action, following the deposition of the oxide and nitride, Ohmi does not teach an additional step of treating the underlying film with a plasma based on a treating gas comprising hydrogen gas.

For at least the reasons that follow, it would not have been obvious to modify Ohmi to include a separate hydrogen gas-based plasma treating step.

The Final Action asserts that it would have been obvious to split the nitridation step of Ohmi into two steps. Such a modification, however, amounts to an impermissible change in the principle of operation of Ohmi.

Ohmi teaches that the nitride layer may be formed using a mixed gas comprising nitrogen and hydrogen, and that the hydrogen is advantageous in reducing the trapping of electrons or holes in the nitride film (see paragraph [0077]). Importantly, Ohmi teaches that the “existence of hydrogen is an important factor when forming a nitride film” (paragraph [0076]). The removal of hydrogen from the nitride film forming plasma as proposed in the Office Action would change the basic principle under which the nitride film of Ohmi is formed. Pointedly, Ohmi teaches the importance of introducing nitrogen gas and then hydrogen gas simultaneously in a mixed gas. A process based on a film forming step and subsequent hydrogen gas-based treating step, where the hydrogen gas is not mixed with the film forming gas, is contrary to the express teaching of Ohmi. If the proposed modification of the prior art would change the principle of operation of the prior art invention being modified, then the teachings of the references are not sufficient to render the claims *prima facie* obvious. *In re Ratti*, 270 F.2d 810, 123 USPQ 349 (CCPA 1959).

As support for the proposition that it is *prima facie* obvious to (i) transpose two steps in a process, or (ii) split one step into two steps, the Office Action relied upon *Ex Parte Rubin*, 128 USPQ 440 (Bd. App. 1959) and MPEP §

2144.04(IV)(C). Applicants respectfully submit that the cited authorities do not support the Office Action's allegation that it would be obvious to split one step into two steps. Further, the facts of the present case are clearly distinguishable from those in *Ex Parte Rubin*.

In *Ex Parte Rubin*, the court found it would have been obvious to reverse the order of two process steps, where each of the process steps had already been taught by the prior art reference. In contrast, the present case involves the addition of a further, as-yet untaught process step. While *Ex Parte Rubin* appears to support the Examiner's conclusion that it is obvious to transpose two steps, the transposition of two steps is not in accord with the facts of the current application. *Ex Parte Rubin* does not address the splitting of one step into two steps. Moreover, the Examiner has cited no authority to support the assertion that it would have been obvious to make such a process modification.

For at least the foregoing reasons, the 4-step processes recited in independent claims 16 and 25 are deemed patentable over the cited references. In addition, Applicants note that claim 25 relates to a process in which a silicon substrate is nitrided, the nitride film is oxidized and, after the oxidizing, the nitride film is treated with a plasma based on a treating gas comprising hydrogen gas.

Ohmi teaches the use of hydrogen gas only in conjunction with a nitridation step. Pointedly, Ohmi does not teach or suggest a hydrogen gas-based plasma step following an oxidation step. Thus, even assuming *arguendo* that it would have been obvious to include a hydrogen gas plasma treating step

immediately after a nitridation step (as recited in claim 16), there is no teaching or suggestion to introduce a hydrogen gas plasma treating step after an oxidation step, as required by claim 25. Reconsideration and withdrawal of the rejections are respectfully requested.


In view of the foregoing, the application is respectfully submitted to be in condition for allowance, and prompt favorable action thereon is earnestly solicited.

If there are any questions regarding this amendment or the application in general, a telephone call to the undersigned would be appreciated since this should expedite the prosecution of the application for all concerned.

If necessary to effect a timely response, this paper should be considered as a petition for an Extension of Time sufficient to effect a timely response, and please charge any deficiency in fees or credit any overpayments to Deposit Account No. 05-1323 (Docket #101249.55459US).

Respectfully submitted,

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Jeffrey D. Sanok
Registration No. 32,169
Michael W. Russell
Registration No. 61,362

CROWELL & MORING LLP
Intellectual Property Group
P.O. Box 14300
Washington, DC 20044-4300
Telephone No.: (202) 624-2500
Facsimile No.: (202) 628-8844
JDS/MWR
dn#4595305